PLANT ITEM MATERIAL SELECTION DATA SHEET

R10685020

CNP-VSL-00004 (PTF)
Cs Evaporator Recovered Nitric Acid Vessel

- Design Temperature (°F)(Max/min): 255/40
- Design Pressure (psig) (Max/min): 15/FV
- Location: incell
- PJM Discharge Velocity (fps): 40
- Drive Cycle: 17 % (at 40 fps)

ISSUED BY RPP-WTP PDC

Offspring items
CNP-PJM-00019 – CNP-PJM-00022
CNP-VSL-00162, CNP-RFD-00005

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on attached Process Corrosion Data Sheet

Operating Modes Considered:

- The vessel is at the stated pH at the normal operating temperature

Materials Considered:

Material (UNS No,.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00	X	
316L (S31603)	1.18	X	
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: 304 (max 0.030% C; dual certified)

Recommended Corrosion Allowance: 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance)

Process & Operations Limitations:

- Develop rinsing/flushing procedure for acid and water

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This bound document contains a total of 6 sheets.

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	APPROVER
3	6/13/06	Issued for Permitting Use		HmK	
2	1/25/05	Issued for Permitting Use	DLA	JRD	SWV
1	6/25/04	Issued for Permitting Use	DLA	APR	SWV
0	1/13/03	Issues for Permitting Use	DLA	JRD	SWV

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Corrosion Considerations:

CNP-VSL-00004 stores recovered nitric acid from CNP-DISTC-00001 at between 115 °F and 140 °F.

a General Corrosion
Hamner (1981) lists a corrosion rate for 304 (and 304L) in 2 M HNO_3 of less than 2 mpy. Davis (1994) states the corrosion rate for 304L in 12% HNO_3 will be less than about 1 mpy up to about 212°F.

Conclusion:
304L is expected to be sufficiently resistant to the waste solution with a probable general corrosion rate of less than 1 mpy.

b Pitting Corrosion
With the stated conditions, 304L will be adequate.

Conclusion:
The data provided suggest there are insufficient halides to cause pitting and 304L would be adequate.

c End Grain Corrosion
Not believed to be applicable to this system.

Conclusion:
Not applicable to this system.

d Stress Corrosion Cracking
The exact amount of chloride required to stress corrosion crack stainless steel is unknown. In part this is because the amount varies with temperature, metal sensitization, and the environment. But it is also unknown because chloride tends to concentrate under heat transfer conditions, by evaporation, and electrochemically during a corrosion process. Hence, even as little as a few ppm can lead to cracking under some conditions. Generally, as seen in Sedriks (1996) and Davis (1987), stress corrosion cracking does not usually occur below about 140°F. Further, the use of "L" grade stainless reduces the opportunity for sensitization. At the concentrations of chloride expected, 304L will be satisfactory.

Conclusion:
The use of 304L is expected to be acceptable for chloride free conditions.

e Crevice Corrosion
See Pitting.

Conclusion:
See Pitting

f Corrosion at Welds
Corrosion at welds is not considered a problem in the proposed environment.

Conclusion:
Weld corrosion is not considered a problem for this system.

g Microbiologically Induced Corrosion (MIC)
The proposed operating conditions are generally not acceptable for MIC.

Conclusion:
Not considered a concern.

h Fatigue/Corrosion Fatigue
Corrosion fatigue is not expected to be a concern.

Conclusions
Not a concern.

i Vapor Phase Corrosion
Not expected to be a concern.

Conclusion:
Vapor phase corrosion is not expected.

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j Erosion
Based on past experiments by Smith & Elmore (1992), the solids are soft and erosion is not expected to be a concern for the vessel wall. Based on 24590-WTP-RPT-M-04-0008, a general erosion allowance of 0.004 inch is adequate for components with solids content less than 2 wt%. Because of the negligible concentration of undissolved solids, no localized protection is necessary for the applicable portions of the bottom head to accommodate PJM discharge velocities of up to 12 m/s for a usage of 100 % operation as documented in 24590-WTP-M0E-50-00003.

The PJM nozzle requires no additional protection as documented in 24590-WTP-M0E-50-00003.

Conclusion:
The recommended corrosion allowance provides sufficient protection for erosion of the vessel.

k Galling of Moving Surfaces
Not applicable.

Conclusion:
Not applicable.

l Fretting/Wear
No contacting surfaces expected.

Conclusion:
Not applicable.

m Galvanic Corrosion
No dissimilar metals are present.

Conclusion:
Not applicable.

n Cavitation
None expected.

Conclusion:
Not believed to be of concern.

o Creep
The temperatures are too low to be a concern.

Conclusion:
Not applicable.

p Inadvertent Nitric Acid Addition
Vessel routinely operates at low pH.

Conclusion:
Not applicable.

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References:

1. 24590-WTP-M0E-50-00003, *Wear Allowance for WTP Waste Slurry Systems*
2. 24590-WTP-RPT-M-04-0008, Rev. 2, *Evaluation Of Stainless Steel Wear Rates In WTP Waste Streams At Low Velocities*
3. 24590-WTP-RPT-PR-04-0001, Rev. B, *WTP Process Corrosion Data*
4. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
5. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
6. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX
7. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158
8. Smith, H. D. and M. R. Elmore, 1992, *Corrosion Studies of Carbon Steel under Impinging Jets of Simulated Slurries of Neutralized Current Acid Waste (NCAW) and Neutralized Cladding Removal Waste (NCRW)*, PNL-7816, Pacific Northwest Laboratory, Richland, Washington.

Bibliography:

1. Agarwal, DC, *Nickel and Nickel Alloys*, In: Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
2. Cole, HS, 1974, *Corrosion of Austenitic Stainless Steel Alloys Due to HNO_3 – HF Mixtures*, ICP-1036, Idaho Chemical Programs – Operations Office, Idaho Falls, ID
3. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
4. Ohl, PC to PG Johnson, Internal Memo, Westinghouse Hanford Co, *Technical Bases for Cl- and pH Limits for Liquid Waste Tank Cars*, MA: PCO:90/01, January 16, 1990.
5. Phull, BS, WL Mathay, & RW Ross, 2000, *Corrosion Resistance of Duplex and 4-6% Mo-Containing Stainless Steels in FGD Scrubber Absorber Slurry Environments*, Presented at Corrosion 2000, Orlando, FL, March 26-31, 2000, NACE International, Houston TX 77218.
6. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
7. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084
8. Wilding, MW and BE Paige, 1976, *Survey on Corrosion of Metals and Alloys in Solutions Containing Nitric Acid*, ICP-1107, Idaho Chemical Programs, Idaho National Engineering Laboratory, Idaho Falls, ID,

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PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) Evaporator recovered nitric acid vessel (CNP-VSL-00004)
Cs evaporator nitric acid distillation column (CNP-DISTC-00001)

Facility PTF

In Black Cell? Yes (only CNP-VSL-00004)

Chemicals	Unit[1]	Contract Max		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/l	3.84E-04	3.86E-04			
Chloride	g/l	4.28E-04	5.12E-04			
Fluoride	g/l					
Iron	g/l					
Nitrate	g/l					Assumption 1
Nitrite	g/l	5.11E-04	6.11E-04			
Phosphate	g/l	8.88E-04	1.04E-03			
Sulfate	g/l	3.36E-04	4.01E-04			
Mercury	g/l					
Carbonate	g/l	1.66E-03	1.82E-03			
Undissolved solids	wt%					
Other (NaMnO4, Pb,...)	g/l					
Other	g/l					
pH	N/A					Note 3
Temperature	°F					Note 2
						Note 4

List of Organic Species:

References

System Description: 24590-PTF-3YD-CNP-00001, Rev 0
Mass Balance Document: 24590-WTP-M4C-V11T-00005, Rev A
Normal Input Stream #: CNP13, CNP14
Off Normal Input Stream # (e.g., overflow from other vessels): N/A
P&ID: N/A
PFD: 24590-PTF-M5-V17T-P0014, Rev 1
Technical Reports: N/A

Notes:

1. Concentrations less than 1x 10^{-4} g/l do not need to be reported; list values to two significant digits max.
2. Tnormal operation 115 °F to 140 °F (24590-PTF-M5C-CNP-00001, Rev 0)
3. Will be highly acidic. pH approximately 0.3
4. 2M nitric acid is added to the vessel.

Assumptions:

1. Based on the presence of 0.5M HNO_3 the nitrate concentration is expected to be approximately 31 g/l (24590-WTP-M4E-V11T-00001, Rev A)

4.1.3 Cs Evaporator Nitric Acid Distillation Column (CNP-DISTC-00001), Cs Evaporator Recovered Nitric Acid Vessel (CNP-VSL-00004)

Routine Operations

Nitric acid vapor enters the nitric acid distillation column, CNP-DISTC-00001, which separates water from the acid. The recovered nitric acid is stored in the Cs evaporator recovered nitric acid vessel CNP-VSL-00004. During elution, nitric acid is pumped from the storage vessel by the Cs IX feed pump, through the feed cooler, and distributed into the system CXP ion exchange columns.

Non-Routine Operations that Could Affect Corrosion/Erosion

None identified.